NRC FORM 618			U.S. NUCLEAR REGULATORY COMMISSION		
CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES					
1 a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9294	5	71-9294	USA/9294/AF-96	1 OF	3

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. ISSUED TO *(Name and Address)*

Global Nuclear Fuel - Americas, LLC
P.O. Box 780
Wilmington, NC 28402

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Global Nuclear Fuel - Americas, LLC, application dated January 29, 2001.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

(1) Model No.: NPC

(2) Description

A cubic stainless steel and foam outer packaging with nine cylindrical containment vessels for the transport of type A quantities of low-enriched uranium oxide powder, pellets, and compounds of uranium as defined in 5(b). The overall package dimensions are approximately 45 inches wide, 45 inches deep, and 44 inches high.

The outer packaging consists of a 10-gage stainless steel outer shell with a ceramic fiber board liner and rigid polyurethane foam filler. The foam filler has a three-by-three array of vertical cylindrical cutouts that accommodate stainless steel sleeves for placement of the containment vessels. The outer packaging is equipped with a top cover that is secured to the outer packaging body by a combination of 16 closure cap screws and four closure strips secured by 24 bolts.

The containment vessel is a maximum 8.515 inches in inner diameter and approximately 32 inches in overall length. The containment vessel is constructed of 18-gage stainless steel, surrounded by a cadmium sheet and polyethylene wrap within a 24-gage stainless steel jacket. The containment vessel is closed by a 16-gage closure lid, a silicone rubber gasket, and a band clamp assembly, which is composed of a 0.063-inch thick strap and retainer, a T-bolt, and a nut.

The gross weight of the package (packaging and contents) is 1,302 kg (2,870 pounds). The maximum weight of the contents is 540 kg (1,190 pounds).

5.(a) (3) Drawings

The packaging is fabricated and assembled in accordance with the following Global Nuclear Fuel - Americas, LLC, Drawing Nos.:

177D4970, Sheet 1, Revision 1
177D4970, Sheet 2, Revision 0
177D4970, Sheet 3, Revision 0
177D4970, Sheet 4, Revision 0
177D4970, Sheet 5, Revision 0
177D4970, Sheet 6, Revision 0
177D4970, Sheet 7, Revision 0
177D4970, Sheet 8, Revision 1
SK105E4037, Sheet 2, Revision 2

(b) Contents

Type, Form, and Maximum Quantity of Material Per Package

Material Forms[1] (≤5.00 wt.% U-235)	Particle Size Restriction: Minimum OD (Inches)	Maximum Loading per ICCA (kgs)		Maximum Loading per NPC (kgs)	
		Net[4]	Uranium	Net[4]	Uranium
Homogenous Uranium Oxide/Compounds[2]	N/A	60.0	52.89	540.0	476.1
Heterogenous UO_2 Pellets (BWR)	0.342	60.0	40.54	540.0	364.8
Heterogenous UO_2 Pellets(PWR)	0.300	60.0	40.54	540.0	364.8
Heterogenous Uranium Compounds[3]	Unrestricted particle size	60.0	40.54	540.0	364.8

[1]No solutions or liquids are authorized and there shall be no free liquid present. The Material Form within any NPC must be the same.
[2]Homogenous compounds limited to UO_2, U_3O_8, $UO_{x,\ x>2}$, dried calcium-containing sludges, $UO_2(NO3)_2{\cdot}6H_2O$, and uranium oxide bearing ash.
[3]Heterogenous compounds limited to UO_2, U_3O_8, and $UO_{x,\ x>2}$.
[4]Maximum content weight of any ICCA including plastic or secondary packaging (i.e., dunnage). Materials with a hydrogen atom density greater than that of water are limited to a mass of 3.7 kg per ICCA.

(c) Criticality Safety Index 0.7

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

   (a) The package must be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7 of the application, as supplemented. Within each ICCA, the contents and secondary packaging (i.e., dunnage) must provide a snug fit. The payload may be enclosed in plastic receptacles (e.g., bags, bottles, etc.). For payloads in plastic bottles, empty bottles may be used to minimize movement of the bottles within the ICCA.

   (b) Each packaging must be acceptance tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Chapter 8 of the application.

7. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

8. Transport by air of fissile material is not authorized.

9. Revision No. 4 of this certificate may be used until November 30, 2008.

10. Expiration date: November 30, 2010.

REFERENCES

Global Nuclear Fuel - Americas, LLC, application dated January 29, 2001.

Supplements dated: August 1, 23 and 27, 2001; March 4 and September 30, 2002; June 30 and October 3, 2005; October 3, 2006; April 27, July 31, and October 3, 2007.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Robert A. Nelson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: November 9, 2007

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT
Model No. NPC Package
Certificate of Compliance No. 9294
Revision No. 5

SUMMARY

By application dated October 3, 2006, as supplemented on December 12, 2006, April 27, July 31, and October 3, 2007, Global Nuclear Fuel – Americas, LLC (GNF or the applicant) submitted an amendment request for Certificate of Compliance No. 9294, for the Model No. NPC package. GNF requested revisions to the certificate for 1) clarification that the package is authorized for type A quantities of uranium bearing material, 2) the addition and revision of drawings, 3) the removal of reference to "metal receptacles" in Condition No. 5(a)(b) Footnote No. 4, and 4) a "-96" designation to the package identification number. The applicant requested the amendment to resolve issues identified during international validation; however the amendment was reviewed for compliance with the regulatory requirements of 10 CFR Part 71. Although the staff acknowledges receipt of responses to European request for additional information, those responses were not addressed in this evaluation.

The Model No. NPC is a cubic stainless steel and foam outer packaging with nine cylindrical containment vessels for the transport of type A quantities of uranium bearing materials enriched up to of 5 weight percent. The contents of the package are sealed within polyethylene receptacles (bottles) which are placed in the inner containment canister assembly (ICCA). The ICCA provides containment of the materials and assures criticality safety.

EVALUATION

By application dated October 3, 2006, as supplemented, GNF requested an amendment to Certificate of Compliance No. 9294 for the Model No. NPC package. Condition No. 2 of the certificate was revised to replace the wording "unirradiated" with "type A quantities." This change makes it clear that the Model No. NPC is authorized for type A quantities of uranium bearing material. The amendment added Drawing No. SK105E4037, Sheet 2, to the certificate. This drawing illustrates the polyethylene bottles, which are shipped inside the ICCA, as components associated with the Model No. NPC package and are included in this amendment approval. Drawing No. 177D4970, Sheet 1 and Sheet 8, was revised to reflect the "-96" designation in the package identification number. Condition No. 8 in the certificate authorizes the use of the previous revision of the certificate for a period of approximately 1 year. Condition No. 8 also allows the Model No. NPC to be marked with the previous package identification number, USA/9294/AF-85, until November 30, 2008. This is to provide the applicant time to replace the packaging nameplate which shows the revised package identification number, USA/9294/AF-96.

STRUCTURAL

The associated structural issues related to GNF's amendment request questioned whether the ICCAs would maintain structural integrity. The amendment request also addresses whether the bottles, bags, and solid contents present within each ICCA have been adequately packed to minimize the dynamic loads on the ICCA lid under the hypothetical accident conditions (HAC) of transport.

Additional package drop testing with the plastic bottles inserted in the package were not performed. As an alternative, GNF provided information in supplement dated April 27, 2007. The supplement illustrates the limited gaps between the three polyethylene bottles and the inner surface of the ICCA to 0.08 inch in the radial direction and 0.15 inch in the axial direction. These polyethylene bottles would not adversely affect the structural performance of the ICCA lid under HAC. The payload may be enclosed in plastic receptacles (e.g., bags, bottles, etc.). For payloads in plastic bottles, empty bottles may be used to minimize movement of the bottles within the ICCA. Additionally, within each ICCA, the contents and secondary packaging (i.e., dunnage) must provide a snug fit to reduce the dynamic loads during HAC. For clarity, Condition No. 6(a) has been revised to assure movement of the contents in the ICCA is minimized. Metallic bottles are not authorized by the certificate for powder payloads. The rigidity of the metallic bottles may impact the ICCA lid at unacceptable levels; consequently the certificate was revised to remove the "metal receptacles" as a packaging component of the Model No. NPC.

THERMAL

The applicant evaluated the package to determine the effect of environmental conditions (ambient temperature and solar insolation) on the various components of the package. These initial conditions are used by the applicant to evaluate the effect of HAC fire during transport. The applicant developed an ANSYS thermal analysis model to evaluate the thermal environment of the ICCA and also performed an oven thermal test. Prior to the fire test, the specimens were placed in an oven and heated to a uniform temperature consistent with the temperatures calculated for the normal conditions of transportation.

The applicant provided an ANSYS thermal analysis and test results to evaluate the effect of fire on the plastic receptacles within the ICCA. The developed axisymmetric ANSYS model includes the ICCA, three polyethylene bottles, and UO_2 contents. The ANSYS model assumed an initial ambient temperature of 132°F and a maximum-recorded ICCA temperature of 365°F to the outer edges of the model, as obtained during the certification tests. The applicant's analysis results showed that, after an hour, the polyethylene bottle reaches a maximum temperature of 338°F. Based on the thermal analysis results, the applicant performed a thermal test of the polyethylene bottles in the predicted temperature range. The thermal test showed that the empty bottles melt at approximately 350°F, which is consistent with analysis provided in the application. For bottles filled with sand, the bottle melts only in the air gap region between contents and lid. The bottles will be supported circumferentially as the bottles deform axially. Based on the thermal tests the applicant concluded that melting of the plastic bag inside the bottles will occur during a HAC fire event. The ICCA (which provides containment of the contents as described in the application) remains unaffected during the HAC fire event.

The staff reviewed the applicant's considerations and concluded that little or no melting of the polyethylene bottles will occur during a HAC fire event and therefore, the payload can be assumed to remain inside the bottles during accident conditions of transport.

CONTAINMENT

As a result of the HAC tests performed on 27 ICCAs contained in the certified test units all but two ICCAs were confirmed not to leak. The two ICCAs exhibiting leakage had small indication of moisture in the dry sand contained within the ICCA, which lead to the applicant requiring that all powder payloads be restrained in plastic bottles within the ICCA. This additional barrier ensures that no powder payload material would be released under HAC, but preserving the ICCA as the sole containment barrier. However, no additional package drop testing was performed with the plastic bottles inserted in the package; instead GNF provided an explanation that these plastic bottles would not adversely affect the structural performance of the ICCA lid under HAC. Augmented thermal testing was performed on the plastic bottles which demonstrated at the anticipated calculated fire temperature of the ICCA that the plastic bottles would still form a barrier to prevent powder release event though significant deformation of the plastic was noted in the oven tests performed. Content forms other than powder (i.e., pellets, rods) do not pose a potential for release through the ICCA lid as demonstrated by the water immersion leak testing, and as a consequence are not required to be contained in the plastic bottles.

CRITICALITY

The applicant submitted an addendum to the criticality safety analysis for the Model No. NPC package for a damaged package array including a heterogeneous study with and without hydrogenous materials. The applicant reduced the allowable contents of the Model No. NPC package. Staff previously reviewed and accepted the contents as adequately meeting the safety standards of 10 CFR Part 71. Based on this premise the staff finds the proposed reduced contents described in the amendment request acceptable.

The applicant performed a series of calculations considering all three particle sizes, referenced in Condition 5(b) of the certificate, assuming the material to be distributed inside the standard Model No. NPC polyethylene bottles inside the ICCA, to account for the effect of inner packaging materials with a hydrogen atom density greater than water inside the ICCA. By performing these additional analyses, GNF provided information regarding the effect of hydrogenous materials with hydrogen atom density greater than water. In the analysis, GNF showed the additional hydrogenous material (poly bottle) decreases overall reactivity for the 2N damaged package array.

The staff performed independent confirmatory calculations for a 5 x 5 x 6 array of packages under HAC, using the Keno V.a and the 238-group ENDF/B-V cross section set in the SCALE 5 system. The staff confirmed that the inclusion of the polyethylene bottle results in a decrease in the overall system subcritical reactivity.

Condition No. 5(b) was revised to reduce the maximum loading per ICCA and NPC package to 40.54 kgs and 364.8 kgs, respectively, for heterogeneous UO_2 pellets. Condition No. 5(a)(3)(b), Footnote No. 1, was revised to ensure that no solutions or liquids are authorized and that there shall be no free liquid present in the material form of the contents. Condition No. 5(a)(3)(b), Footnote No. 4, was revised to remove the "metal receptacles" as a packaging component of the Model No. NPC. This change was made for clarity. In the original submittal of the application for the Model No. NPC, the applicant intended to use the metal receptacle as a future option, but it was never used or developed. Condition No. 5(a)(3), Footnote No. 4, also added text to state, "[m]aterials with a hydrogen atom density greater than that of water are limited to a mass of 3.7 kg per ICCA."

OPERATING PROCEDURES

The operating procedures in Section 7 of the application were slightly revised to remove a reference to "metal receptacles" (see discussion above) and to modify the first loading step for clarity. Section 7.1.2, "Loading the Payload into the NPC," step 1, includes a verification to ensure that the limits for uranium oxides and compounds meet the limits established in the certificate and do not exceed a Type A quantity of material.

"-96" REQUEST

GNF requested approval for a "-96" designation for the Model No. NPC package. The package was issued a "-85" designation in the package identification number on February 23, 2007. GNF submitted information supporting the request for a "-96" approval on July 31, 2007. The applicant revised their application to incorporate the "CSI" nomenclature in Section 6. The final rule adopted 10 CFR 71.55(f), which addresses packaging design requirements for packages transporting fissile material by air. GNF stated that this requirement is not applicable to the Model No. NPC package. Therefore, for clarity, the certificate has been revised to specify that air transport is not authorized. As a result of adding this condition to the certificate, Condition Nos. 8 and 9 were renumbered 9 and 10, respectively. The other changes indicated for a "-96" designation are not applicable to the Model No. NPC package. Changes to the package design are not required in order to meet the provisions for a "-96" designation. The package identification number has been revised to USA/9294/AF-96 to indicate that the package meets the requirements of the revised 10 CFR Part 71 regulations which became effective October 1, 2004 (69 FR 3698). Based on the statements and representations in the application, the staff concluded that the design has been adequately described and meets the requirements of 10 CFR Part 71 for a "-96" approval.

CONCLUSION

As requested by the applicant the package identification number has been revised to include the "-96" designation. The Certificate of Compliance has also been revised to include the amendment requested by the applicant. These changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9294, Revision No. 5 on
November 9, 2007.